SEACHANGE INDONESIA

GILI ASAHAN

OCEAN OF WONDERS

Alwan Syah

GILI ASAHAN
OCEAN OF WONDERS

Affiliated with Seachange Indonesia

Writer : Alwan Syah
Photography : Alwan Syah
Lay-out : Alwan Syah

First Print, Jan 2023
VI + 64 pages
QRCBN 62-1948-9454-419

Typeset in Malayalam MN with Acumin Variable Concept
Printed and bound in Bekasi, West Java, Indonesia

Acknowledgements

Collecting, classifying, and organizing various photographs of marine life in Gili Asahan can only be realized with the help and contributions of many individuals. This project wouldn't be finished without the help of Pearl Beach Resort and Oceanway Dive as our main operation base. Special gratitude is given to key contributors: Dr. Alexandra Seifert, Jake Langford, Niek Wassink, and the entire Pearl/Oceanway crew. Their dedication and support enhanced the project's scope and impact. Lastly, the author would like to express their thanks towards their family and friends who believed in the cause.

Contents

Preface

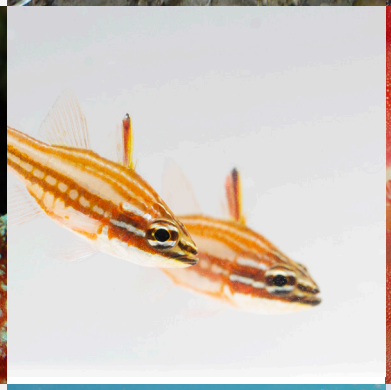
Indonesia's seas are among the most biodiverse place in the world. Its strategic location along the equator, as well as its geographical position between the two continents of Asia and Australia and the two oceans of the Indian and Pacific, enables a wide range of life to inhabit and thrive in its waters.

In the coastal areas, three types of ecosystems can be found: mangrove forests, seagrass meadows, and coral reefs. Indonesia boasts the second-longest coastline in the world, providing a home for various flora and fauna. The country is particularly known for its extensive coral reef ecosystems, covering an area of approximately 85,707 square kilometers, equivalent to 18% of the total global coral reef ecosystem. The Gili Asahan: Ocean of Wonders project showcases the diversity of marine life at Gili Asahan. Despite its narrow space, this small area accommodates a wide variety of marine life.

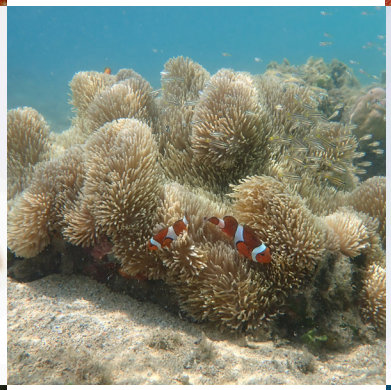
This book delves deeper into the marine diversity, one by one, using macro photography techniques on most photos so that often overlooked elements can be more appreciated for their beauty. Through this book, the author hopes to raise awareness among the public about our marine life and inspire more people to contribute to the conservation of Indonesia's seas. Every effort, no matter how small, has a significant impact on global initiatives.

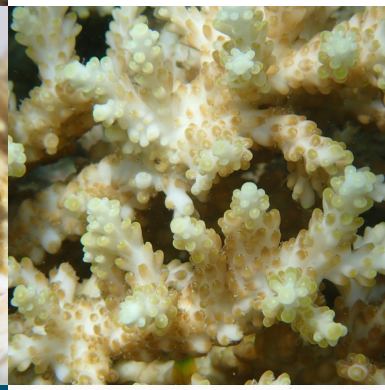
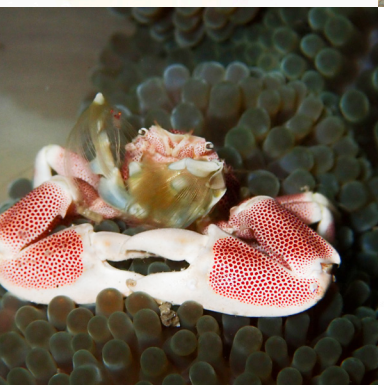
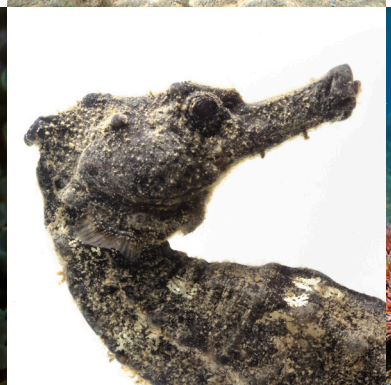
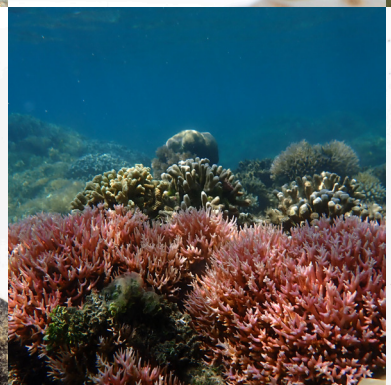




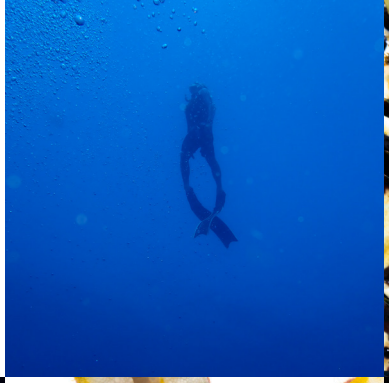
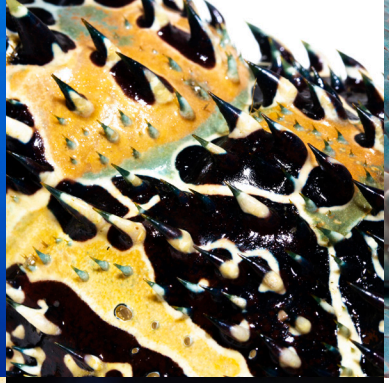







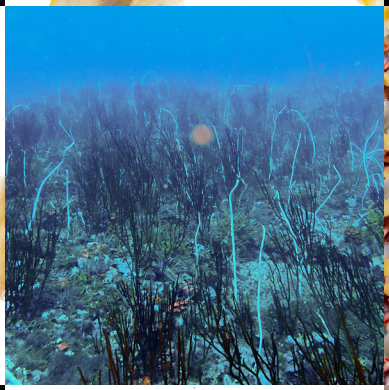















About Us

Healthy coral reefs are among the most biologically diverse and economically valuable ecosystems on earth, providing valuable and vital ecosystem services. Coral ecosystems – besides being astonishingly beautiful – are a source of food for millions; protect coastlines from storms and erosion; provide habitat, spawning and nursery grounds for all kinds of fish and other aquatic species; provide jobs and income to local economies from fishing, recreation, and tourism; are a source of new medicines, are hotspots of marine biodiversity; and play a huge role in the health of the global enviroment.

At Seachange Indonesia, we are committed to doing our part to make the world a better place. Since 2005, the founders of Seachange Indonesia have been engaged in a wide range of activities to conserve the coral reefs and marine live of Indonesia, with our main operations located in Sekotong Bay area, Gili Asahan.

Seachange Indonesia is empowering individuals, initiatives and communities in doing so every day. We have established constructive and fruitful relationships with our collaborative partners so that we can achieve our goals quickly, sustainably and with continuous impact. Our programs involved coral restoration, education, research, and outreach.

Over the past 10 years, there have been many successful coral projects all around the local area and we have seen an unbelievable change not just to the coral numbers but also to the marine life! One of the most successful projects were 80 frames with each up to 40 coral fragments that were planted 2017 in Gili Asahan and which are now full of growing corals and marine life.

Looking forward, Seachange Indonesia is dedicated to advancing marine conservation by expanding coral restoration, increasing educational outreach, and conducting vital research. Our goals include empowering local communities economically, forming new collaborative partnerships, and embracing innovative techniques in coral conservation. As global advocates, we aim to actively contribute to international forums, promoting sustainable marine management practices. Through these initiatives, we aspire to build on our past successes, fostering resilient marine ecosystems and inspiring positive change for the oceans and communities.

The flower stalk of *Enhalus acoroides* seagrass. Pollination happens underwater, where the pollen is released to the water column and taken by the current.

Submerged Meadows

From the coastline, seagrass meadows greet you with their distinct leaves. This underwater expanse comprises multiple species, including flowering plants; the seagrass itself, and different kinds of algae. Seagrass meadows play a crucial part in a coastal ecosystem. Among others are biodiversity hotspots, water regulators, and carbon sinks.

Like our inland meadows, seagrass supports high biodiversity by providing a habitat for various marine organisms. They serve as nurseries and feeding grounds for many fish and invertebrates. Seagrass also regulates water nutrients by absorbing them before they reach the coral reef, as coral reefs can only thrive in low-nutrient environments. Additionally, seagrasses are highly effective at capturing and storing atmospheric carbon dioxide.

Halimeda Green Algae
Halimeda sp.

Bell Algae
Turbinaria sp.

Seagrass
Halophila sp.

Building Blocks of the Reef

Despite their seemingly sessile plant-like appearance, corals are, in fact, animals. They belong to the phylum **Cnidaria**, alongside sea jellies, man o' war, and anemones. Corals can be solitary, but many form colonies in which numerous individuals - called polyps - are connected by living tissue.

Colonies of polyps collectively build the physical foundation of the reef through the secretion of calcium carbonate, which referred as corralite or skeleton. This structure can vary widely in size and shape, ranging from small, solitary corals to large, expansive formations. The skeleton provides crucial structural support for the colony and contributes significantly to the gradual formation of coral reefs over time.

Shallow corals are known for having mutualistic symbiosis with pigmented algae called **Zooxanthellae**. The algae live within the tissues of the coral polyps and provide them with nutrients through photosynthesis. In return, the corals offer protection and access to sunlight.

Cauliflower Coral ▶
Pocillopora damicornis
Corallites up to 2 mm

Each circle in this coral represents an individual called a "polyp", while the individual skeleton is referred to as a "coralite". A colony develops asexually through budding, resulting in the entire coral having the same genetic makeup. Near the bottom left, you can observe scarring on a part of the colony, presumably due to predation. It is evident how the structure has been affected.

Coral reef ecosystem, featuring *Acropora spp.*, *Seriatophora hystrix*, *Echinopora sp.*, and *Porites sp.*

Various *Acropora* coral shapes, colors, and variations.

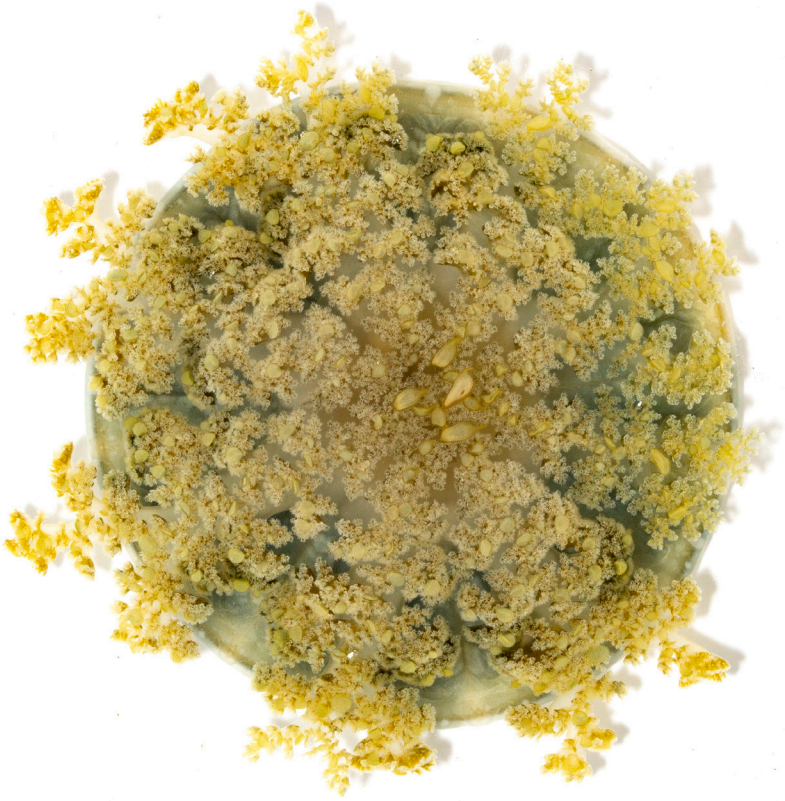
Different coloration and behaviour in broccoli soft coral (Nephtheidae). The one on the left seems to be swollen and retracted, while the one on the right is more relaxed.

Softies and Gelatinous

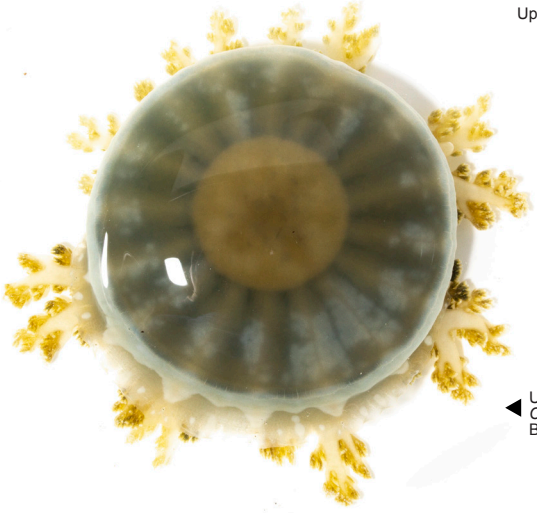
While not achieving the same level of dominance as their reef-building Scleractinian relatives, other Cnidarians contribute significantly to the intricate tapestry of marine ecosystems.

Soft corals (**Octocorallia**) exemplify this diversity with their distinct feeding strategy. Using eight delicate tentacles, these corals capture plankton and detritus from the surrounding water, playing a crucial role in nutrient cycling. As like any other sesile benthic animals, soft corals also host an array of small animals like shrimps and bristle stars.

Additionally, other members of the Cnidaria phylum, such as sea jellies (**Medusozoa**), exhibit a different life-style. These gelatinous organisms gracefully swim freely through the water, possesing stinging organel in their tentacles called nematocysts. This specialized organel sits on cnidocytes cells which contains venom-bearing micro harpoon that could easily pierce human skin and cause allergic reaction. They control populations of small marine organisms and are a food source for various marine creatures, including sea turtles.



Upside-down Sea Jelly (Downside) ▲
Cassiopea sp.
Bell up to 35 cm (14 in.)



◀ Upside-down Sea Jelly (Topside)
Cassiopea sp.
Bell up to 35 cm (14 in.)

Beaded Anemone (Downside) ▲
Heteractris aurora
Up to 30 cm (12 in.)

Beaded Anemone ▼
Heteractris aurora
Up to 30 cm (12 in.)

The Apple Doesn't Fall Far from the Tree

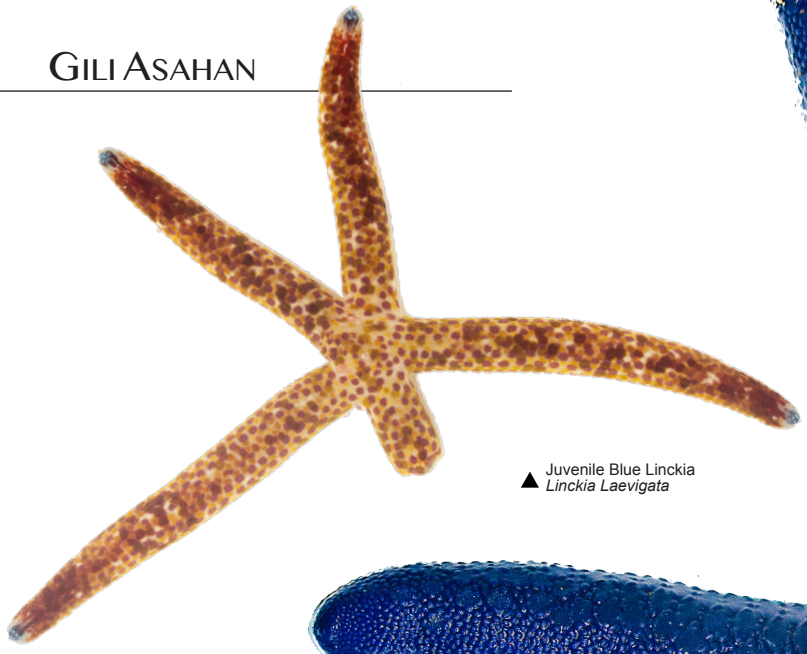
Sea anemones (**Actiniaria**) are relatives to corals. Just like their cousins, sea anemones engage in a mutualistic symbiosis by hosting a diverse array of marine organisms, ranging from the humble shrimp to the territorial damselfish.

It appears that the tendency to establish associations runs in the family after all, underscoring the interconnected and cooperative nature of marine ecosystems.

Sexy Shrimp ▶
Thor amboniensis
Up to 2 cm (3/4 in.)

Sexy shrimps (*Thor amboniensis*) are often found in anemones or soft coral in groups.

The carpet anemone (*Stichodactyla gigantea*), along with its symbiotic relationship with false clownfish (*Amphiprion ocellaris*), is widely known. What most people don't know is that all clownfish are born as males. There is a strict hierarchy with a dominant female at the top, followed by a dominant male, and then subordinate males. When the dominant female is removed or dies, the dominant male will undergo a sex change and become the new female. The highest-ranking subordinate male will then move up to become the new dominant male. This makes clownfish protandrous hermaphrodites. This anemone also seems to host another kind of animal, the porcelain crab (*Neopetrolisthes maculata*).



▲ Juvenile Blue Linckia
Linckia Laevigata

The Blue Linckia (*Linckia laevigata)* is a common sea star in our house reef. This mesmerizing critter started out as a swimming larvae. As it grows, it gradually settles on the ocean floor and develop its bright blue pigment.

Adult Blue Linckia ▲
Linckia Laevigata
Up to 30 cm (12 in.)

Cleaners of the Ocean Floor

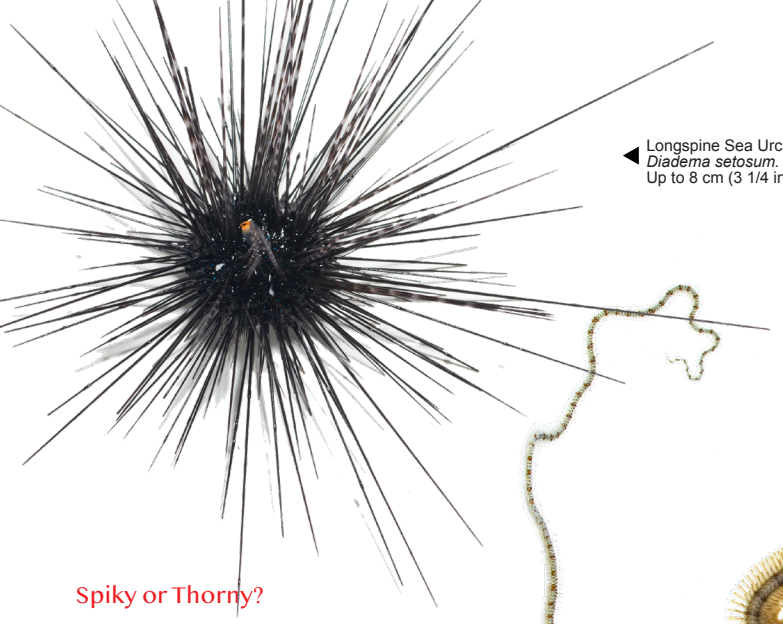
Echinoderm is a term for animals belonging to the Echinodermata phylum. The classification includes sea stars, brittle stars, sea cucumbers, sea urchins, and feather stars or sea lilies. This animal group plays a crucial role in a marine ecosystem, as most echinoderms feed on detritus. Some species, known as key-species, are also appointed as bio-indicators that could be used to indicate the ecosystem's health.

I'm a Star!

Sea stars (**Asteroidea**) possess hundreds of small tube feet, known as podia. These appendages function collaboratively, serving both as a means of transportation and as tools for capturing food. Notably, true sea stars exhibit a remarkable ability to regenerate lost limbs. In a fascinating display of adaptability, asexual reproduction can occur from a severed limb, a life-stage referred to as 'comets.'

The adorable cushion sea star (*Culcita novaeguineae*), as the name suggest, resembles a pentagonal pincushion. It feeds on detritus, but occasionally also feeds on stony corals.

This dark red-spined brittle star (*Ophiothrix purpurea*) (arms up to 15 cm) was observed hanging on soft coral during the night, presumably feeding on zooplankton by utilizing its spiny arms to catch it.



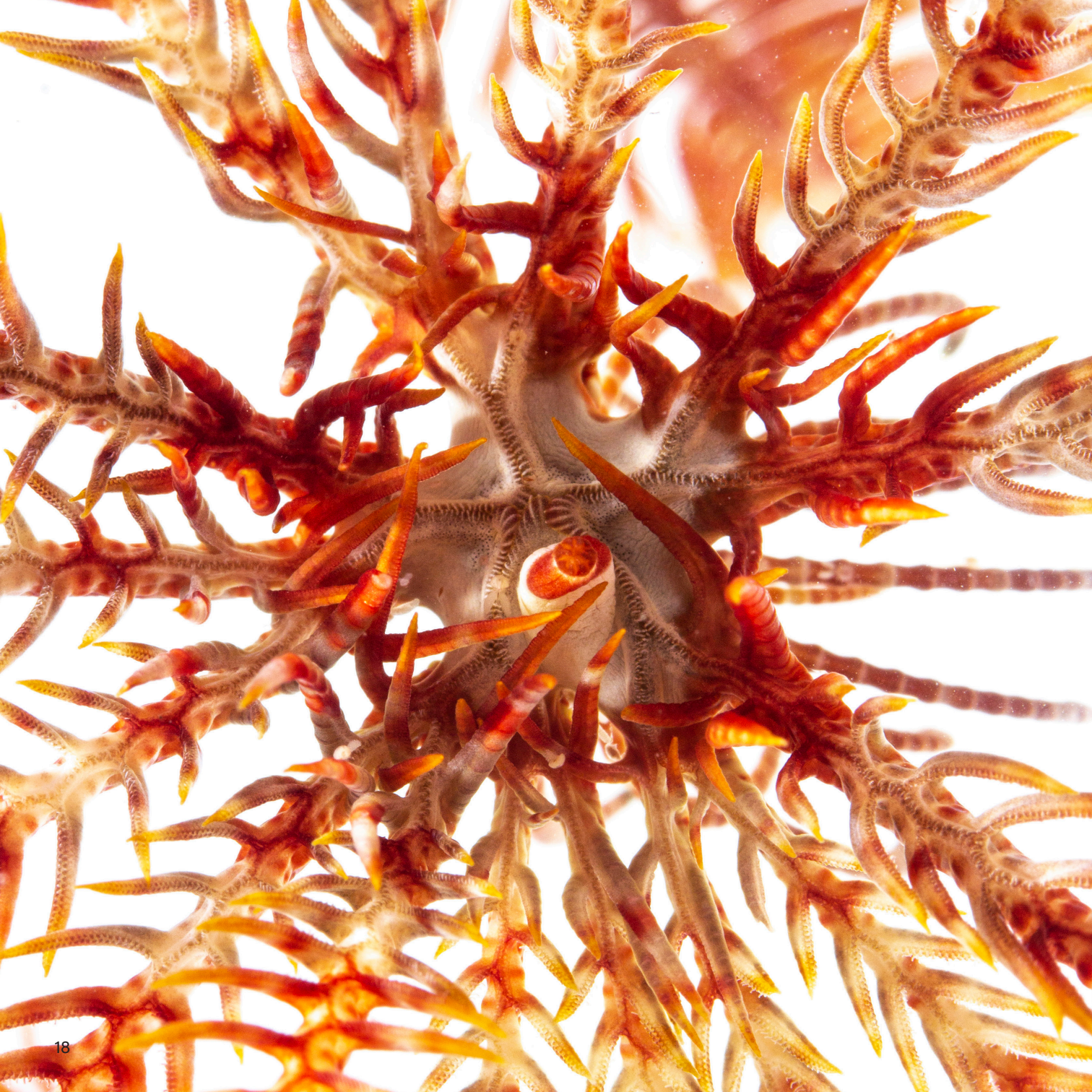
Longspine Sea Urchin
Diadema setosum.
Up to 8 cm (3 1/4 in.)

Spiky or Thorny?

Sea urchins and brittle stars share a common evolutionary heritage despite their distinct appearances and behaviors. Sea urchins (**Echinoidea**) typically exhibit a spherical or flattened body covered in a calcareous shell with movable spines, inhabiting diverse ocean environments and primarily feeding on algae. The spines of various families can vary, from long to short, thin to thick, and pointed to blunt. Being a nocturnal, sea urchins usually comes out only during the night to feed.

In contrast, brittle stars (**Ophiuroidea**) have a star-shaped body with long, flexible arms radiating from a central disk. Each arms exhibit an array of numerous spines arranged in rows and can vary in shape and size. Also known as serpent stars, brittle stars can be found in various marine habitats and employing opportunistic feeding strategies.

Burrowing Bristle Star
Amphiodia sp.
Arms up to 30 cm

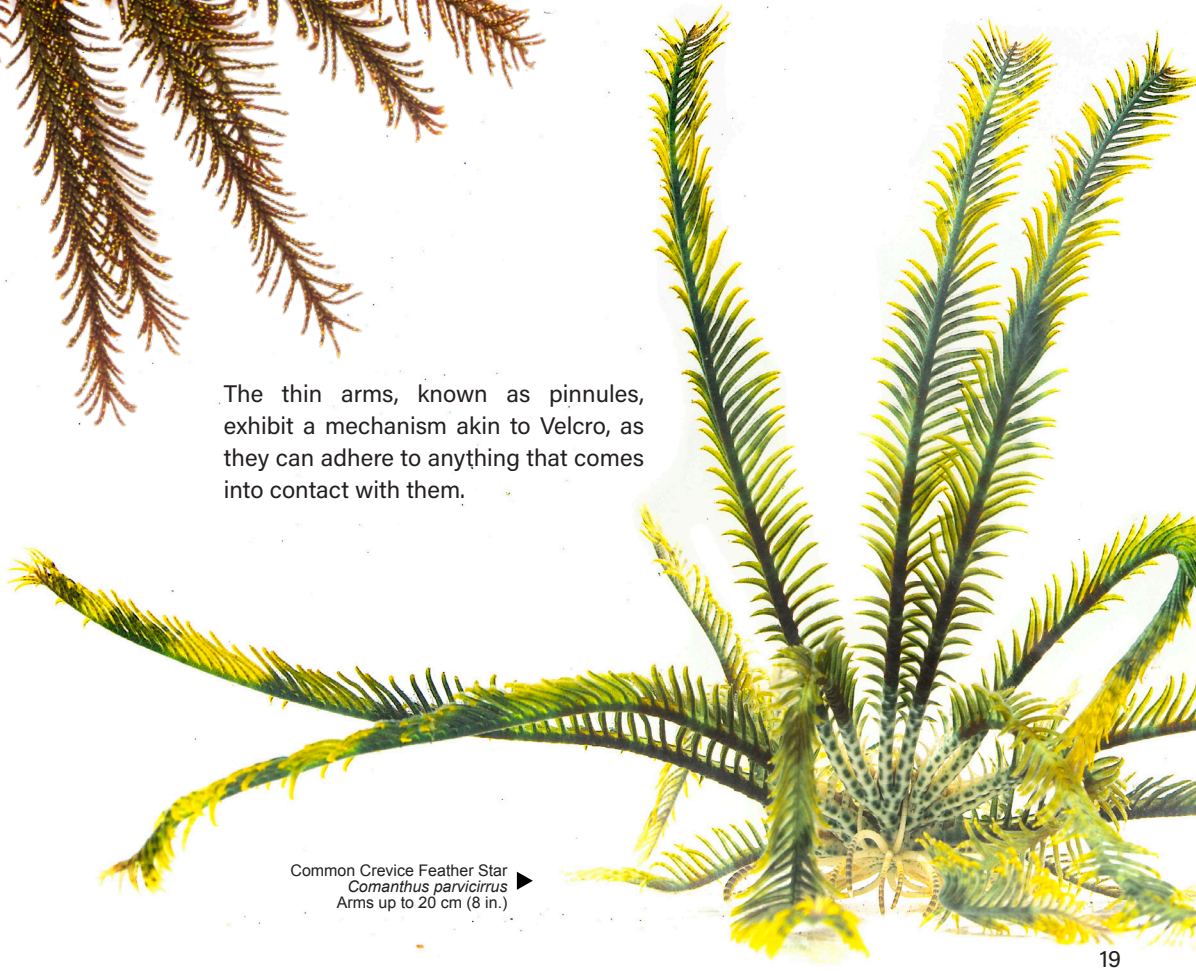


Lilies of the Sea

Feather stars, along with sea lilies, represent the most ancient forms of echinoderms and are collectively known as **Crinoids**. These living fossils are equipped with multiple arms that serve the purpose of sweeping water to capture food: detritus and sometimes zooplanktons.

▲ Undetermined Feather Star
Comaster sp.

The thin arms, known as pinnules, exhibit a mechanism akin to Velcro, as they can adhere to anything that comes into contact with them.



◀ Undetermined Feather Star
Stephanometra sp.

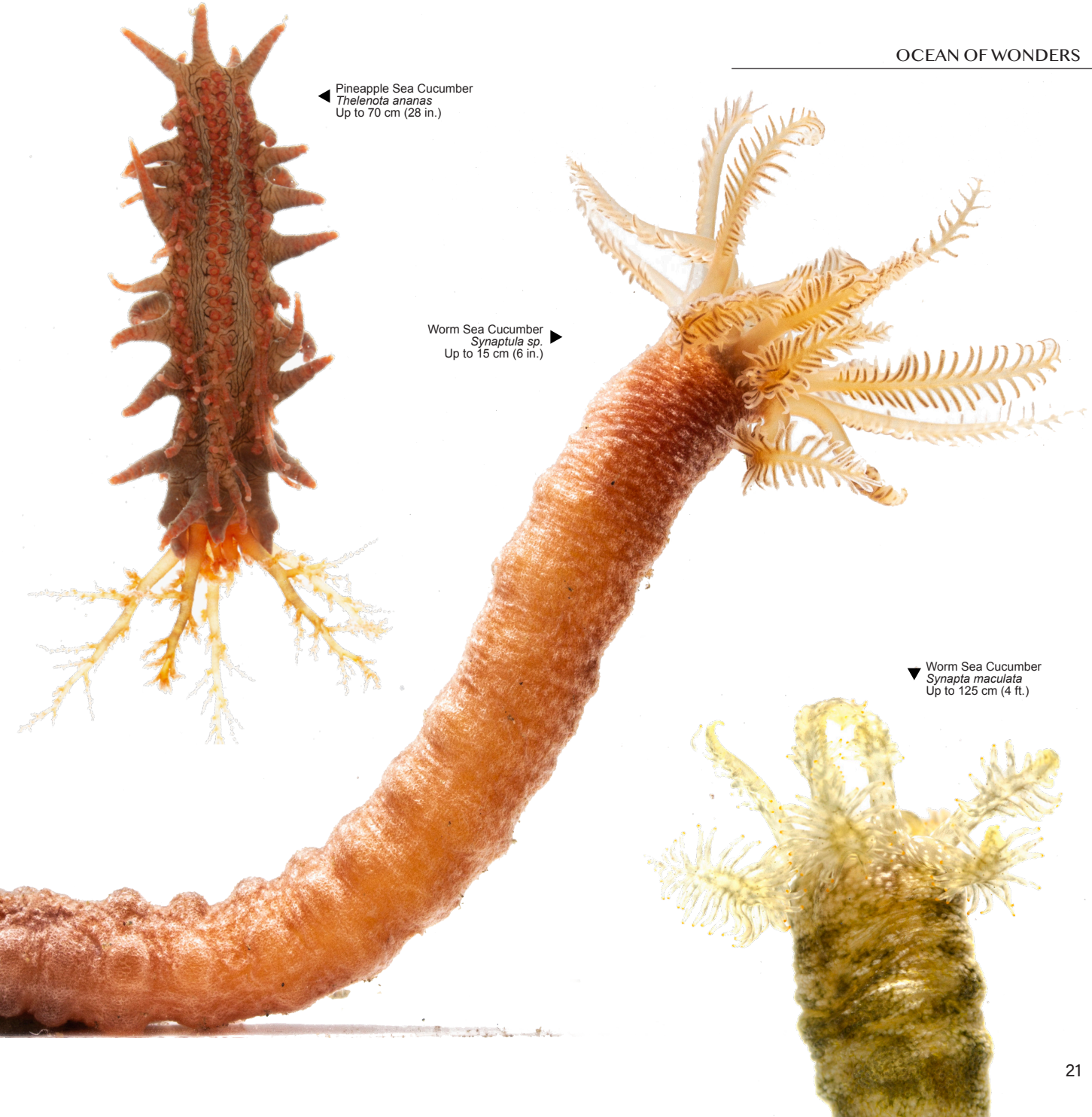
Common Crevice Feather Star ▶
Comanthus parvicirrus
Arms up to 20 cm (8 in.)

The Sea Pickle

Sea cucumbers (**Holothuroida**) are unlike any other Echinoderms. They have long, thick cylindrical bodies with a mouth at one end and an anus at the other end. The shared trait of five sections from all Echinoderms is only apparent when sea cucumbers are viewed across its axis. Various species of sea cucumbers also lead different lifestyles. Several species are free-living, moving about in the sand, leaving a trail behind. Other species buried themselves in the sand, using their modified tube feet as a holdfast to attach their bodies to the substrate, while the mouth stayed overground, giving an anemone-like appearance.

The Lolyfish sea cucumber (*Holothuria atra)* is inclined towards sandy areas, where it conceals its black body by adorning it with sand particles, creating distinct "bald spots" to seamlessly blend in with the environment.

▼ Lolyfish Sea Cucumber
Holothuria atra
Up to 60 cm (24 in.)



◀ Pineapple Sea Cucumber
Thelenota ananas
Up to 70 cm (28 in.)

Worm Sea Cucumber ▶
Synaptula sp.
Up to 15 cm (6 in.)

▼ Worm Sea Cucumber
Synapta maculata
Up to 125 cm (4 ft.)

The horn-eyed ghost crab (*Ocypode ceratophthalmus*) display a mesmerizing eyestalks, extending beyond the eyes into long points, giving a horn-like appereance.

Claws for Hands

Arthropods make up the largest phylum in the Animal Kingdom, with over two million described species, including marine animals such as crabs, shrimps, and lobster. Land insects, scorpions, and spiders constitute the rest of the Arthropoda phylum. The most distinguishable features of all members of this phylum are jointed legs and an exoskeleton made of chitin, connected by flexible membranes to allow movement.

In marine ecosystems, **Crustaceans**, such as krill and anemone-host shrimps, occupy key roles. Krill, tiny crustaceans, are vital to the food web, serving as a primary source for whales, seals, and fish. Anemone-host shrimps establish symbiotic relationships, seeking refuge among sea anemones' tentacles while providing cleaning services by removing parasites.

One intriguing phenomenon in the Crustacean sub-phylum is carcinization, in which non-true crabs (**Brachyura**) evolved independently into a crab-like body form. It suggests that this form is particularly well-suited for certain ecological niches, driving multiple lineages to independently arrive at this advantageous morphology.

▼ Swimming Crabs
Cycloachelous granulatus
Up to 5 cm

▼ Undetermined Crab
Brachyura

▲ White Hermit Crab
Calcinus minutus
Up to 1.5 cm (1/2 in.)

Hermit crabs of various kinds often gather together to exchange shells. Thiis congregation often observed in shallow, rocky beach .

◀ Hermit Crab
Calcinus latens
Up to 1.5 cm (1/2 in.)

▼ White-spotted Hermit Crab
Dardanus megistos
Up to 15 cm (6 in.)

Constantly Renovating

Hermit crabs (**Anomura**) use empty shells, produced by mollusks as mobile protective retreats. They hold on to the shells utilizing a specially modified abdomen that coils into the spirals of the shell. As the shells do not grow together with the hermit crab, they must find another, bigger shells multiple times throughout their lives.

The anemone hermit crab (*Dardanus pedunculatus*) carries symbiotic anemone on their shells. Their anemones usually stick with them their whole live and are transferred to the new shell every time the hermit crab moves.

This peacock mantis shrimp (*Odontodactylus scyllarus*) is very curious on what's going on in its surroundings. The picture was taken when our team conducted coral frames maintenance, and seems to be intrigued by the photographer.

Shed skin of painted spiny lobster (*Panulius versicolor*). The lobster gets out of its old exoskeleton by splitting the connections between its head and abdomen.

◀ Painted Spiny Lobster
Panulius versicolor
Up to 40 cm (16 in.)

Growing My Own Skin

All Arthropods grow a strong, thick exoskeleton that provides them excellent protection. However, this structure has its own drawbacks. The exoskeleton can restrict growth and thus needs to be shed periodically, called **molting**. During the molting process, Arthropods become more vulnerable as the new skin hardened. Because of this reason, molting is usually done in secluded recesses, away from predators.

I was Never Here

Multiple critters opt for camouflage as their defense mechanism. Spider and decorator crabs are known to exhibit this behavior. In addition to moving very lifeless and rock-like, they attach their surrounding items like algae, rock, and even coral to their bodies to help blend in with their environments.

Decorator Crab ▶
Carapace size vary

Ornamental Spider Crab ▼
Schizophyrs aspera
Carapace up to 6 cm (21/4 in.)

This spider crab (*Schizophyrs aspera)* was found in a field of pencil shaving algae. It is apparent how the spider crab utilize the items unique to its enviroment to blend in.

Giant Clam
Tridacna sp.

Conch Snail
Strombus sp.
Shell up to 15 cm (6 in.)

She Sells Shells by the Sea Shore

Mollusca has exerted dominance over the oceans since the Cambrian period (541–485.4 million years ago), represents a diverse and significant component of marine life. Comprising approximately 23% of all named marine creatures, mollusks exhibit unparalleled diversity in terms of body plans, size, behavior, and habitat when compared to other animal phyla.

This diverse group of marine invertebrates encompasses various classes, each with unique characteristics. Among them are bivalves, exemplified by the giant clam (*Tridacna*), characterized by their two-part shells. Gastropods, which include snails and slugs, showcase a variety of shell forms, from coiled to uncoiled. Cephalopods, such as squids and octopuses, stand out for their advanced intelligence, complex behaviors, and well-developed nervous systems. Additionally, chitons contribute to molluscan diversity with their segmented and armor-like shells.

Bat Volute
Cymbiola vespertillio
Shell up to 16 cm (6 1/4 in.)

Home is Where I Belong

Snails, also known as **Gastropods**, constitute the largest class of mollusks. This shell-bearing group comprises over 35,000 species worldwide. The most distinctive feature of snails are, of course, their shells, which grow as a tubular whorl, forming an ever-enlarging cone-shaped structure.

Other animals actively hunt snails for food. Some snail species have developed an intricate array of shell structures and even produce venom as a defense mechanism. Additionally, certain animals, such as the hermit crab, utilize empty shells as their own homes. When a shell is left to wash ashore, the relentless force of powerful waves repeatedly striking it causes gradual erosion until the shells are reduced to sand.

The Black Velutinid (*Coriocella nigra*) often mistaken as a sea slug due to its internal shell.

Black Velutinid
Coriocella nigra
Up to 10 cm (4 in.)

▲ Slender Roboastra
Roboastra gracilis
Up to 25 mm

◀ Gloomy Tambja
Tambja morosa
Up to 70 mm

More Than Just Slimy Slugs

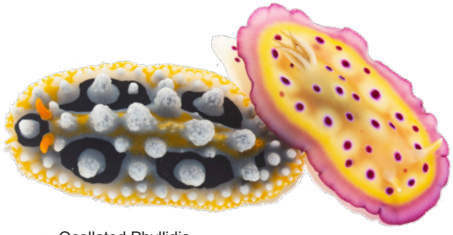
Opisthobranchia is an informal umbrella term encompassing a diverse array of marine sea slugs that exhibit various shapes, sizes, and structures. The most characteristic feature of this mesmerizing group is the reduction or loss of the shell, as well as the elaboration of anatomy, including well-defined head, at least one pair of oral tentacles and foot/mantle. Additionally, they are known for employing chemical defense mechanisms, a trait independently acquired by various lower animal groups or taxa. These structural similarities have arisen on multiple independent occasions through parallel evolution, where two or more sea slug groups have adapted to similar niches in different locations.

▼ Pleasant Chelidonura
Chelidonura amoena
Up to 40 mm

▼ Chelidonura
Chelidonura sp.
Up to 45 mm

▼ Moon-faced Euselenops
Euselenops luniceps
Up to 80 mm

▼ Kunie's Chromodoris
Chromodoris kuniei
Up to 60 mm



▲ Ocellated Phyllidia
Phyllidia ocellata
Up to 2 cm

▲ Leaf Sheep Slug
Costasiella kuroshima
Up to 4 mm

▼ Batangas Halgera
Halgera batangas
Up to 40 mm

▲ Lumpy Asteronotus
Asteronotus cespitosus
Up to 25 cm

▲ Swollen Phyllidia
phyllidia varicosa
Up to 12 cm

▲ Phyllidia Variant
Phyllidia sp.

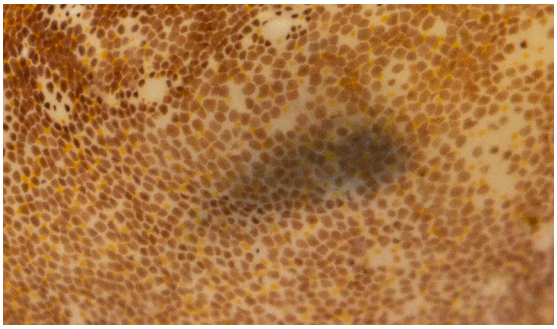
▲ Black-margined Glossodoris
Glossodoris atromarginata
Up to 5 cm

This bobtail squid (*Euprymna berryi)* displays a remarkable opalescent iridescent with its chromatophores. It is apparently also in a defensive pose, threatened by the presence of the photographer.

The Smartest of them All

Cephalopods, like octopuses and squids, can change their skin color and pattern using special cells called chromatophores. These cells come in three types: pigmented ones for colors, reflective ones for iridescence, and light-producing ones for bioluminescence. The cephalopods' advanced nervous system allows them to control these cells quickly, helping with camouflage, communication, and expressing emotions.

Being highly intellegent, cephalopods also posses an array of intelectual skills, such as problem-solving and even tool-usage. These animals have good memories and can learn from their experiences. Their brains are different from ours, but they're still pretty complex. Cephalopods also communicate to each other using patterns on their skin, body movements, and lights. When they're in danger, they can squirt out ink to make a smokescreen and escape quickly.



Complex arrangements of chromatophores that helps cephalopod change colors and pattern.

▼ Freshly Hatched Cuttlefish
Sepia sp.
Up to 50 cm (20 in.)

▲ Bobtail Squid
Euprymna berryi
Up to 7 cm

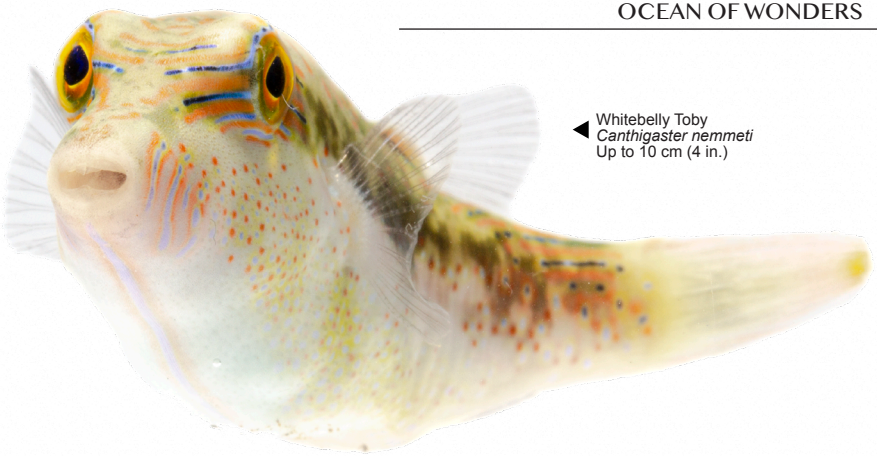
This starry-night octopus (*Callistoctopus luteus*) glides very swiftly through the reef's crevices in an attempt to escape from the pursuing photographer. It seems to be annoyed by my presence.

Group of Orange-spotted Spinefoot (*Siganus guttatus)*

Just Keep Swimming

Coral reefs harbor the most varied collections of fish globally, hosting an estimated 6,000 to 8,000 species within the ecosystems of the world's oceans. Scientists are still debating why this is the case, but several different factors might contribute to this biodiversity. A few are rich habitat complexity and diversity inherent in coral reef ecosystems and availability and diversity of food.

Reef fish also has several adaptations. Being in more confined and complex landscapes of the coral reef, fishes develop a laterally compressed body to optimize maneuverability in reef holes and crevices. In contrast, fishes living in open water have a more streamlined body type. Fish in coral reefs also display a variety of dazzling colors and patterns which serve different functions in different fishes. For instance, the vibrant colors of the clownfish play a crucial role in communication and species recognition. Additionally, the bold patterns on the regal angelfish help them blend into their coral surroundings, providing effective camouflage from potential predators.



◀ Whitebelly Toby
Canthigaster nemmeti
Up to 10 cm (4 in.)

Threadfin Butterflyfish (Juvenile) ▶
Chaetodon auriga
Up to 22 cm (9 in.)

▼ Cardinalfish
Apogon sp.
Up to 9 cm (3 1/2 in.)

Striped Catfish
Plotosus lineatus
Up to 32 cm (13 in.)

Safety in Numbers

Fish schooling or shoaling is a mesmerizing behavior displayed by various species of fish. In fact, About one-quarter of fish species shoal all their lives, and about one-half shoal for part of their lives. Fish gain numerous advantages from exhibiting such behavior, like improved defense mechanisms against predators. This is achieved by confusing the predators by the amount of individuals, thus reducing capture risk. Schooling also offers the probability of finding more food and finding mates.

▲ Razorfish
Aeliscus strigatus
Up to 15 cm (6 in.)

Aggregation of Cardinalfish (*Apogon sp.*)

Aggregation of Blue-green Chromis (*Chromis viridis)*

The blackspotted sole (*Aseraggodes melanosticus*) blends seamlessly with the bare sand bottom, completely invisible to the unaware eye.

▲ Twospot Lizardfish
Synodus binotatus
Up to 17 cm (6 3/4 in.)

Now You See Me, Now You Don't

Bottom-dwelling fish have evolved camouflage strategies that enable them to blend into their underwater surroundings. Some fish adopt a background-matching strategy, where their skin pigments closely resemble the colors and textures of the seafloor, rocks, or coral they inhabit. Additionally, certain fish have developed a flatten body type and the ability to change their skin color to match their surroundings. These adaptations serve multiple purposes, including avoiding predation, ambushing prey, and enhhancing their overall survival in underwater environments.

The sandpercher digs a hole in the bare sand sea floor and hangs around it, looking for food and retreating to the hole when it senses danger.

Sandpercher ▶
Parapercis sp.
Up to 28 cm (11 in.)

Spiny Devilfish ▼
Inimicus didactylus
Up to 18 cm (7 in.)

Spectacular view of spiny devilfish (*Inimicus didactylus*) fan-like pectoral fins with dark semicircle around the base.

Equipped with Weapons

Camouflage is not the only technique fishes have up their fins. Some species combined both camo and stinging spines to enhance their overall survival. While the camouflage helps them feed on smaller animals, their venomous spines protect them from potential predators. This adaptation became more evident when more and more people got stung when accidentally stepped on a seemingly lifeless bare sand bottom.

Cockatoo Waspfish (Juvenile) ▼
Ablabys taenianotus
Up to 15 cm (6 in.)

Devil Scorpionfish (Juvenile) ▼
Scorpaenopsis diabolus
Up to 28 cm (11 in.)

▲ Spotfin Lionfish
Pterois antennata
Up to 20 cm (8 in.)

This greenish devil scorpionfish (*Scorpaenopsis diabolus)* easily blends in with its rocky-rubbly surroundings. Unaware visitors might mistake it as a regular stone from the surface, that's why it is not advisable to stand on the rocks.

A pregnant male seahorse (*Hippocampus taeniopterus)* with bloated pouch. The fries could burst out any day now.

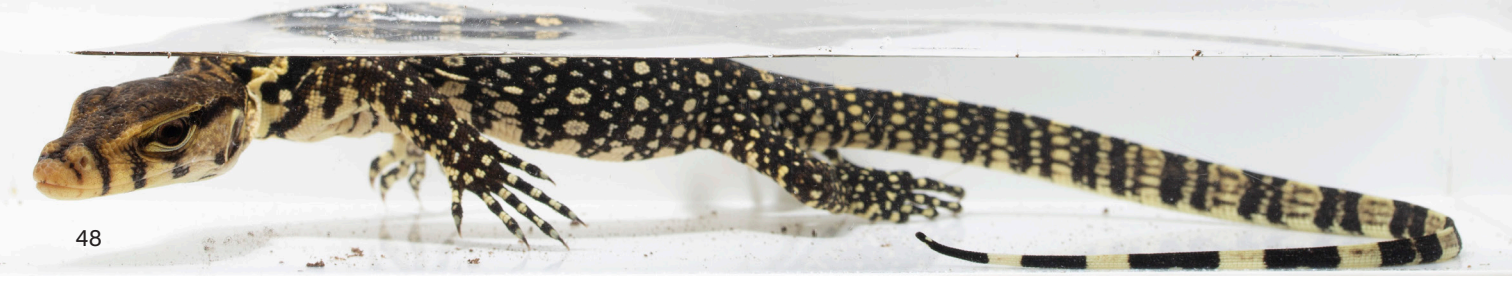
Common Seahorse (Male)
Hippocampus taeniopterus
Up to 22 cm (8 1/4 in.)

Common Seahorse (Female)
Hippocampus taeniopterus
Up to 22 cm (8 1/4 in.)

Species Highlight: The Seahorses

Seahorses are a very unique creature, both anatomically and behaviorally. For starters, seahorses look unlike any other fish. This animal has a very distinct equine-like appearance, with bent necks and long-snouted heads, in addition to a distinctive trunk and tail. Seahorses are also poor swimmers, only being able to swim vertically, compared to swimming horizontally like most fishes. They compensate for this by camouflage and hanging on seagrass. On top of that, male seahorses bear the eggs in their brood pouch, transferred from the female during mating. After 9-45 days, many young averages 100–1000, are released into the water.

While the water monitor lizard (*Varanus salvator*) spends most of its days inland, this reptile is known to go from one island to another by swimming. Its long and whip-like tail helps it to move around the water. It also hunts fish and crabs, mainly in mangroves and estuaries.



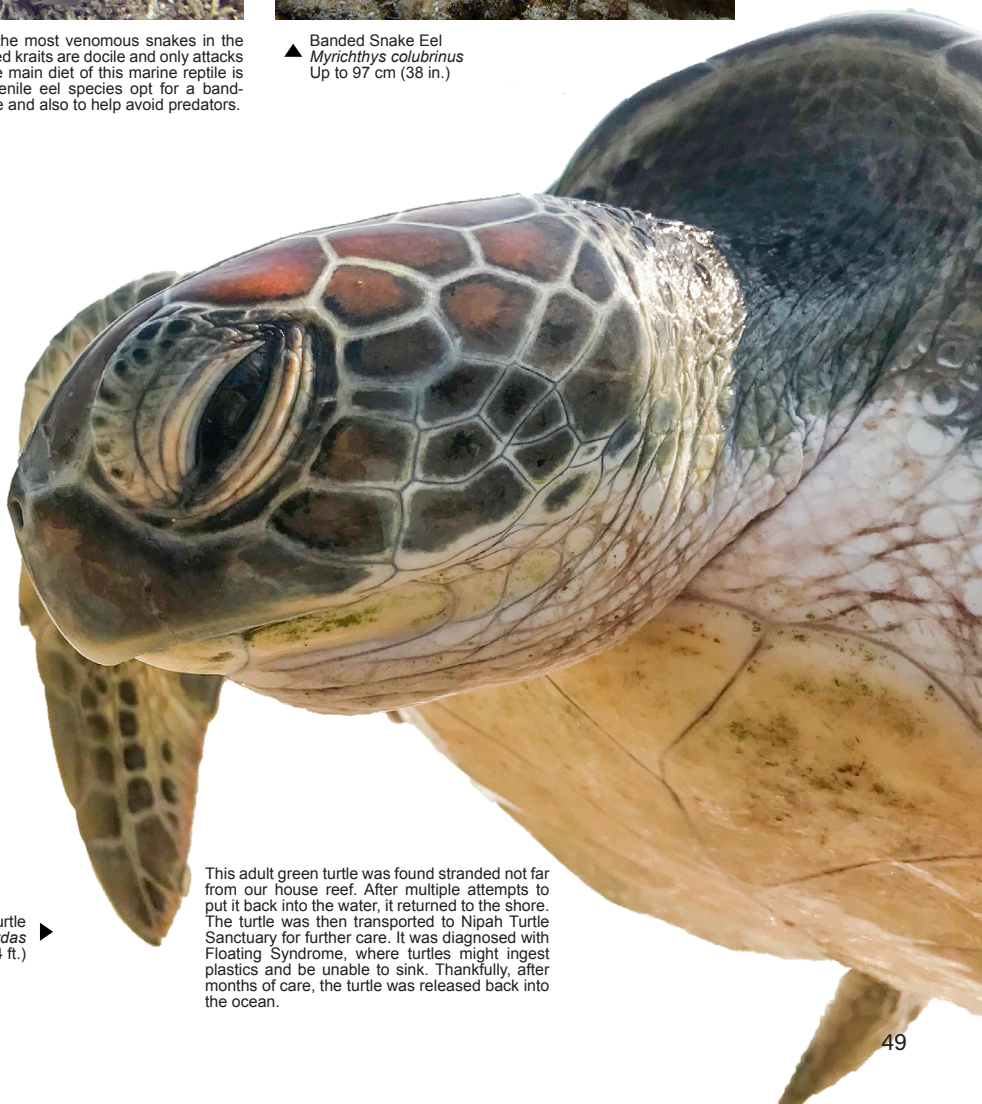
▲ Banded Sea Krait
Laticauda colubrina
Up to 128 cm (50 in.)

Banded sea krait is one of the most venomous snakes in the world. That being said, banded kraits are docile and only attacks as a last-resort defense. The main diet of this marine reptile is eels, that's why several juvenile eel species opt for a banded-like color to fool the snake and also to help avoid predators.

▲ Banded Snake Eel
Myrichthys colubrinus
Up to 97 cm (38 in.)

The Legacy

Invertebrates and fishes aren't the only creatures that live in the ocean. 66-2.6 million years ago during the Paleogene and Neogene periods, marine reptiles dominated the seas, ranging from colossal mosasaurs to dolphin-like Ichthyosaurs. While they're now extinct, their legacy endures with the presence of different kinds of modern marine reptiles, such as sea turtles and sea snakes. They both evolve structures that make them live comfortably in the waters, such as fin-like flippers and tails, and increased lung capacity. However, sea turtles need to go inland to lay eggs, whereas sea snakes keep their eggs inside and birth live young underwater.



Green Sea Turtle ▶
Chelonia mydas
Up to 115 cm (4 ft.)

This adult green turtle was found stranded not far from our house reef. After multiple attempts to put it back into the water, it returned to the shore. The turtle was then transported to Nipah Turtle Sanctuary for further care. It was diagnosed with Floating Syndrome, where turtles might ingest plastics and be unable to sink. Thankfully, after months of care, the turtle was released back into the ocean.

Early Life

Many marine creatures like fish and invertebrates release vast quantities of tiny eggs and sperm into the water during spawning events. These gametes then unite, forming fertilized embryos that embark on an incredible adventure. From the moment of conception, these early life forms face numerous challenges as they navigate the vastness of the ocean currents, evading predators and seeking optimal environments for growth. Some species undergo various developmental stages, from the vulnerable larval phase to the more resilient juvenile stage, gradually adapting to their marine habitats.

A cuttlefish in its developmental stage. It already develops eyes, tentacles, and internal bones, but still has its yolk attached.

Cuttlefish
Sepia sp.
Up to 50 cm (20 in.)

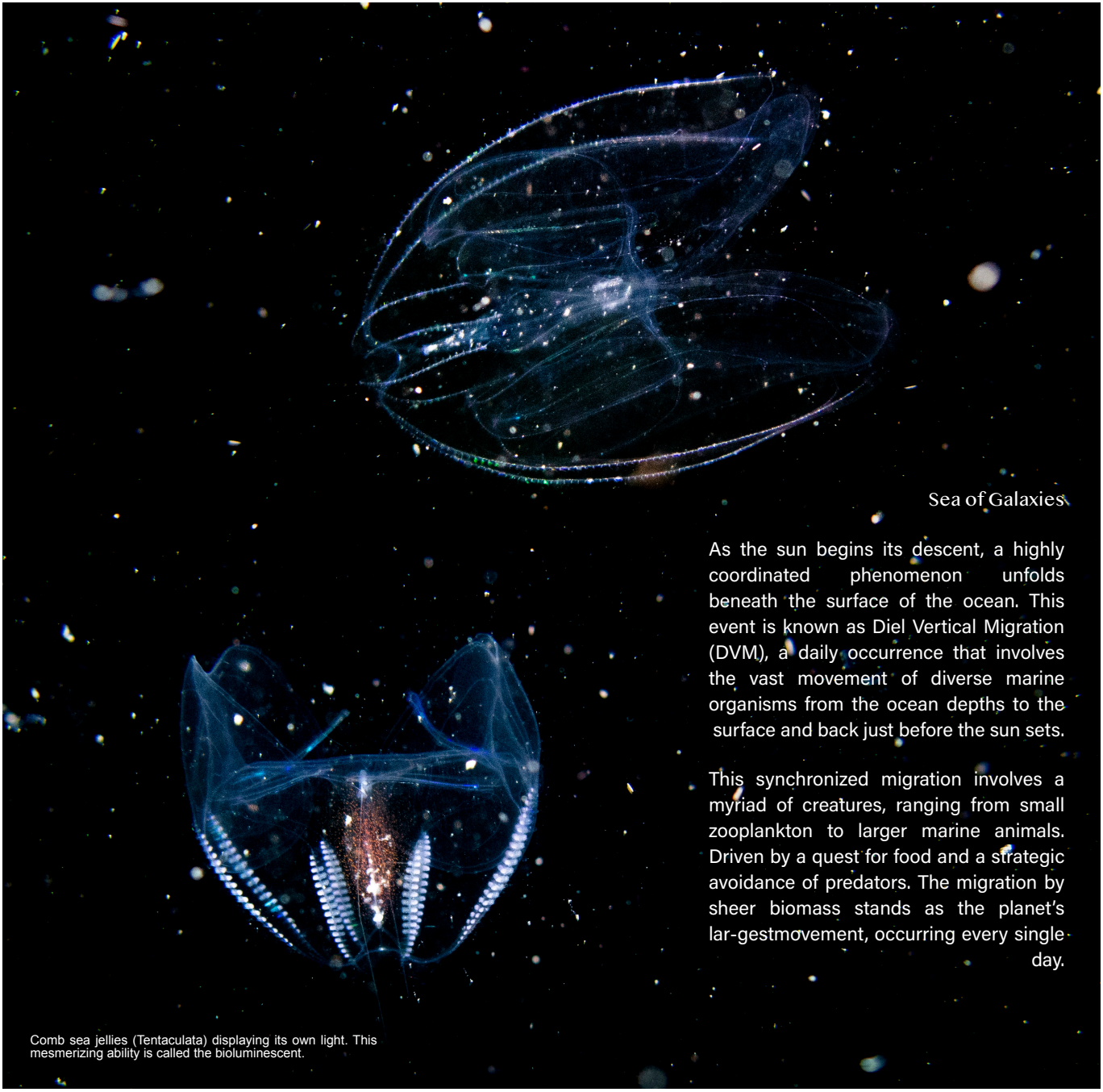
Convict Surgeonfish (Juvenile)
Acanthurus triostegus
Up to 27 cm (11 in.)

This baby surgeonfish (*Acanthurus triostegus)* adaptation is their transparent bodies, providing them with a near-invisibility that serves as a natural camouflage. The transparency not only helps them blend into the surrounding water but also makes them less conspicuous to predators hunting from below or above.

This juvenile orbicular batfish (*Platax orbicularis)* looks exactly like a dead leaf. It drifts with the current and scan the waters for food, but also dangers. As it grows older, the shape of the its body becomes more round and the coloration gradually becomes stripy black and white.

Orbicular Batfish (Juvenile)
Platax orbicularis
Up to 60 cm (24 in.)

Many invertebrates attached their eggs to the substrate instead of releasing it into the water column. These cuttlefish eggs are attached to a coral before the it was washed ashore to the beach.



Sea of Galaxies

As the sun begins its descent, a highly coordinated phenomenon unfolds beneath the surface of the ocean. This event is known as Diel Vertical Migration (DVM), a daily occurrence that involves the vast movement of diverse marine organisms from the ocean depths to the surface and back just before the sun sets.

This synchronized migration involves a myriad of creatures, ranging from small zooplankton to larger marine animals. Driven by a quest for food and a strategic avoidance of predators. The migration by sheer biomass stands as the planet's lar-gestmovement, occurring every single day.

Comb sea jellies (Tentaculata) displaying its own light. This mesmerizing ability is called the bioluminescent.

Flatworm (Polycladida) swimming its way in a zooplankton-filled waters.

The Future

In this modern age, the coral reef ecosystem faces a variety of threats. These threats can have catastrophic impacts not just on coral reefs but also on marine life - and even us humans. From a multitude of threats, the culprit could be traced back to human-induced activities: human development, pollution, and climate change.

Human development like over/illegal fishing, coastal infrastructure, and tourism took a heavy toll on coral reefs. If left unregulated, said expansion could result in increased sedimentation, and eventually habitat destruction.

Pollution such as agricultural run-off and plastic waste could choke coral reefs and many marine animals to death. Chemically, farm nutrients could lead to an algal bloom and make the water toxic. Plastic in so many ways could get into the system of marine animals, even degraded ones, which is referred to as micro-plastic. Both could lead to water quality degradation and diseases.

Crown-of-thorns sea star scar on *Pocillopora* coral. Note the difference between live coral, dead coral, and dead coral with algae growing on it.

Crown-of-thorns Sea Star ▲
Acanthaster planci.
Up to 35 cm (14 in.)

While two of those factors might be observed locally, climate change took things to another level: it happens globally. Climate change is caused by increased levels of carbon dioxide in the atmosphere, which leads to ocean acidification. Such an event leads to a weakened structure of corals. The increased heat caused by it also makes more coral predators thrive, like the population boom of the crown-of-thorns. Additionally, prolonged heat could also lead to corals releasing their symbiotic algae, the Zooxanthellae, in an attempt to keep cool. If the heat is prolonged for an extensive amount of time, corals cannot fetch enough food to feed themselves and starve to death.

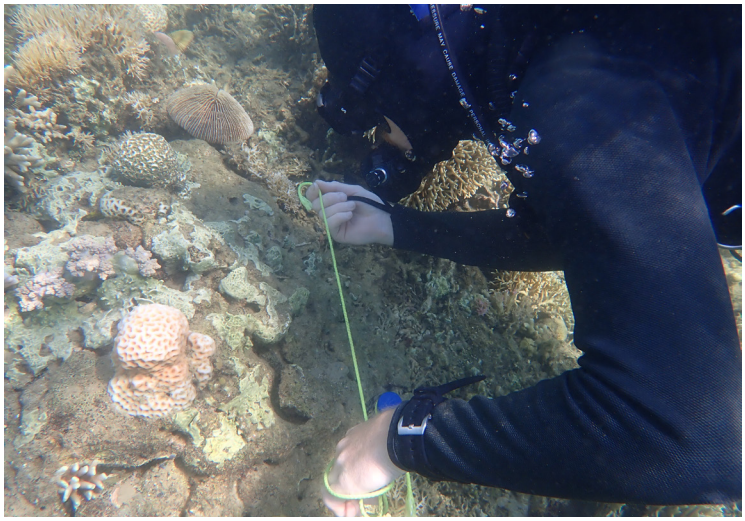
Bleached *Seriatopora hystrix* coral colony. As algae grow on top of them, their food supply is limited. If the coral cannot recover, it will die from starvation.

Plastic pollution is a notorious problem in our ocean, but sometimes the seas claim back what was given to them. This PVC pipe was colonized by algae and even new coral. At one end, it's observed that there's a gobyfish residing in it. These two shows how fragile, yet very resilient the marine ecosystem is.

Hopes & Dreams

The degradation of coral reefs is not without hope. here in Seachange Indonesia, we are committed to various activities surrounding coral reefs and marine ecosystem restoration/conservation. We repopulated the deserted, rubble bottom sea in our house reef for more than 10 years. Additionally, we also have an outreach with universities on coral research to determine heat-resistant coral in hopes of facing more extreme climate change in the few next years.

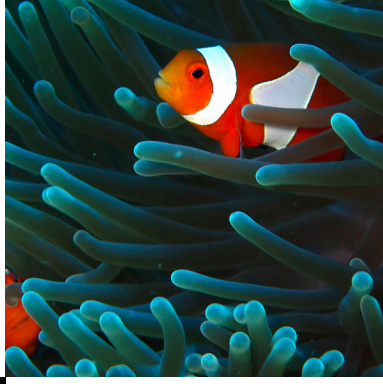
Despite our efforts, change needs to happen globally. Public awareness and education campaigns play a vital role in fostering a sense of stewardship for coral reefs, encouraging communities to adopt environmentally friendly practices. On top of that, collaboration among governments, NGOs, scientists, and local communities is essential for the successful conservation and restoration of coral reef ecosystems. By addressing these challenges collectively, we can work towards preserving the biodiversity of marine habitats for the next generations to come.

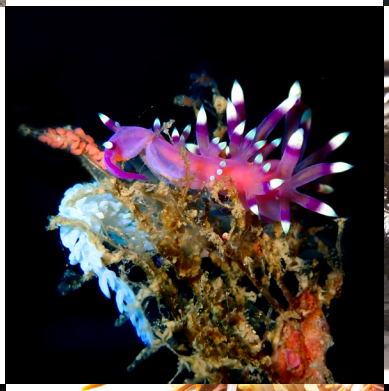


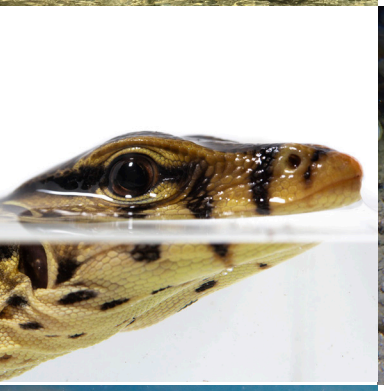
Our diver doing coral benthic coverage survey. A temporary station marker was placed, and every 1 meter a picture was taken. In total, there would be 50 pictures from 50 meters of sea floor.

Multiple coral recruits growing on steel frames in our house reef. Steel frame structures gives stability that bare rubble bottom couldn't provide, thus promoting coral growth.



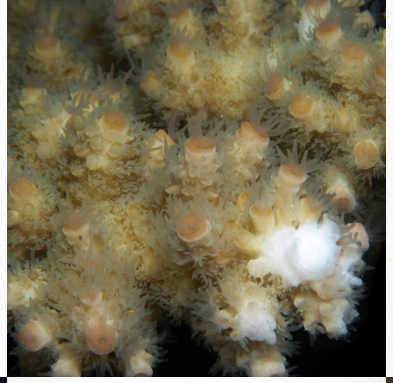













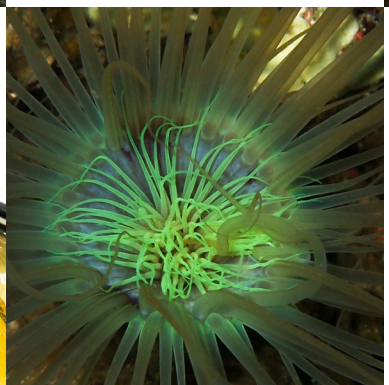











Bibliography

Allen, G., Steene, R., Humann, P., Deloach, N. (2007). *Reef Fish Identification: Tropical Pacific*. Jacksonville, Florida USA: New Worlds Publication, Inc.

Coleman, N. (2008). *Nudibranchs Encyclopedia: Catalogue of Asia/Indo-pacific Sea Slugs*. Springwood, Australia: Nevile Coleman's Undewater Geographic Pty Ltd.

Erhardt, H. & Knop, D. (2005). *Korallen Fuhrer*. Stuttgart, Germany: Kosmos.

Humann, P. & Deloach, N. (2020). *Reef Creature Identification: Tropical Pacific*. Jacksonville, Florida USA: New Worlds Publication, Inc.

About the Author

Alwan Syah is a hobbyist-turned-conservationist and photographer with a focus on coral reefs. His love for nature began in childhood when he was introduced to zoos and public aquariums. He pursued studies in Visual Communication Design at Universitas Negeri Malang and Biology at Universitas Terbuka. Combining his visual skills with a deep understanding of nature, he aims to raise awareness through his work about the importance of biodiversity, not only for the living organisms within it but also for humanity. He can be reached through Instagram: @papasplanta, linkedIn: Alwan Syah or email: alauddinsyahalwan@gmail.com.

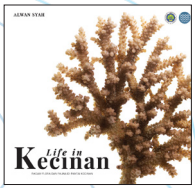
Other works by the author:

Lautan (2020)
A point-and-click game based on Windows with pixel art style centered around the ocean, from the coastline to the deep sea.

Available at semuasiji.itch.io

Marine Paintings (2021)
Four series of digital illustrations depicting marine life.

Available at behance.net/alwana



Life in Kecinan (2023)
Undergraduate thesis project, showcasing the abundance of biodiversity found in only a 1 km square area of Kecinan Bay, Lombok Utara.

Available at archive.org/details/lifeinkecinan